

WHAT IS CLAIMED IS

1. An electro-magnetic field analysis program of an electric rotating machine for a computer to execute:

the first electro-magnetic field analysis procedure of  
5 analyzing the electro-magnetic field in an analysis space  
based on the first boundary condition in terms of an electro-  
magnetic variable assigned to the first specific portion in  
the analysis space;

a development procedure of developing the electro-magnetic  
10 variable at the second specific portion in the analytic space,  
obtained in the first electro-magnetic field analysis  
procedure, into each higher-harmonic component;

the second boundary condition setting procedure of  
assigning an electro-magnetic variable in terms of at least  
15 one of the higher-harmonic components, developed from the  
above electro-magnetic variable, to the second specific  
portion as the second boundary condition; and

a procedure of analyzing the electro-magnetic field of the  
analysis space based on the first and second boundary  
20 conditions.

2. An electro-magnetic field analysis program of an  
electric rotating machine according to claim 1, wherein, in  
the development procedure, the electro-magnetic variable is  
developed into each higher-harmonic component in terms of  
25 spatial distribution.

3. An electro-magnetic field analysis program of an

electric rotating machine according to claim 1, wherein, in the development procedure, the electro-magnetic variable is developed into each higher-harmonic component in terms of time distribution.

5           4. An electro-magnetic field analysis program of an electric rotating machine according to claim 1, wherein the electro-magnetic variable is potential or magneto-motive force.

          5. An electro-magnetic field analysis program of an electric rotating machine according to claim 1, wherein a  
10 storage procedure of storing the permeability distribution of the analysis space is included before the first electro-magnetic field analysis procedure, and, in the first and second electro-magnetic field analysis procedures, the electro-magnetic field analysis of the analysis space is based  
15 on the permeability distribution stored in the storage procedure.

          6. An electro-magnetic field analysis program of an electric rotating machine according to claim 1, wherein the analysis space comprises an analysis space corresponding to  
20 the stator and an analysis space corresponding to the rotor, and the second specific portion is the boundary between the analysis space corresponding to the stator and analysis space corresponding to the rotor.

          7. An electro-magnetic field analysis program of an  
25 electric rotating machine for a computer to execute:

        a total electro-magnetic field analysis procedure of

analyzing the total electro-magnetic field of the electric rotating machine by assigning a boundary condition to the outer boundary surface of the analysis space and applying a magneto-motive force by current or magnetic force;

5           a procedure of storing the permeability distribution in the magnetic substance obtained in the total electro-magnetic field analysis procedure;

          a procedure of developing the potential, which describes the electro-magnetic field distribution on the sliding surface  
10       between the rotor and stator obtained in the total electro-magnetic field analysis, into multiple higher-harmonic components that have some distribution in the axial direction and a constant or periodic distribution in the direction of rotation;

15           a procedure of accomplishing a linear electro-magnetic field analysis in each rotor space including the rotor and stator space including the stator, wherein the same boundary condition as in the total electro-magnetic field analysis procedure is assigned, a Dirichlet's condition is assigned to  
20       the sliding surface, the stored permeability distribution is assigned and fixed to the whole analysis space, and current or magnetic force applied in the total electro-magnetic field analysis procedure is applied; and

          a procedure of accomplishing a linear electro-magnetic  
25       field analysis in each rotor space including the rotor and stator space including the stator, wherein the same boundary

condition as in the total electro-magnetic field analysis  
procedure is assigned, the higher-harmonic components are  
assigned, one after another, to the sliding surface as the  
boundary condition, the permeability distribution is assigned  
5 to the whole magnetic substance, and current or magnetic force  
is set zero.

8. An electro-magnetic field analysis program of an  
electric rotating machine according to claim 7, wherein, in  
the case of analyzing a three-dimensional rotating structure,  
10 in the procedure of analyzing the electro-magnetic field of  
the electric rotating machine by assigning a boundary  
condition to the outer boundary surface of the analysis space  
and applying a magneto-motive force by current or magnetic  
force, a procedure of converting a potential obtained under a  
15 gage-free or partially gage-free condition into a potential  
meeting the gage condition is executed before the procedure of  
developing the potential into the higher-harmonic components.

9. An electro-magnetic field analysis program of an  
electric rotating machine according to claim 7 or 8, wherein a  
20 procedure of displaying the electro-magnetic field  
distribution, obtained through individual analysis in the  
above-mentioned each rotor space and stator space,  
individually by each assigned boundary condition.

10. An electro-magnetic field analysis program of an  
25 electric rotating machine for a computer to execute:

a total electro-magnetic field analysis procedure of

analyzing the total electro-magnetic field of the electric rotating machine in a series of time steps by assigning a boundary condition to the outer boundary surface of the analysis space and applying a magneto-motive force by current  
5 or magnetic force;

a procedure of storing the permeability distribution in the magnetic substance in a series of time steps obtained in the total electro-magnetic field analysis procedure;

a procedure of developing and storing the potential, which  
10 describes the electro-magnetic field distribution on the sliding surface between the rotor and stator obtained in the total electro-magnetic field analysis, into multiple higher-harmonic components that have some distribution in the axial direction and a constant or periodic distribution in the  
15 direction of rotation;

a procedure of abstracting the time and spatial higher-harmonic components by developing the multiple higher-harmonic components which, obtained in the above analysis in a series of time steps, have a constant or periodic distribution in the  
20 direction of rotation into higher-harmonic components along the time axis;

a procedure of accomplishing a linear electro-magnetic field analysis in each rotor space including the rotor and stator space including the stator, wherein the same boundary  
25 condition as in the total electro-magnetic field analysis procedure is assigned, a Dirichlet's condition is assigned to

the sliding surface, current or magnetic force applied in the total electro-magnetic field analysis procedure is applied, and the permeability distribution in the magnetic substance in a series of time steps is assigned in each time step; and

5        a procedure of accomplishing a linear electro-magnetic field analysis in each rotor space including the rotor and stator space including the stator, wherein the same boundary condition as in the total electro-magnetic field analysis procedure is assigned, the time and spatial higher-harmonic  
10       components are assigned, one after another, to the sliding surface as the boundary condition, the permeability distribution in the magnetic substance in a series of time steps is assigned and fixed in each time step, and current or magnetic force is set zero.

15       11. An electro-magnetic field analysis program of an electric rotating machine according to claim 10, wherein, in the case of analyzing a three-dimensional rotating structure, in the procedure of analyzing the electro-magnetic field of the electric rotating machine by assigning a boundary  
20       condition to the outer boundary surface of the analysis space and applying a magneto-motive force by current or magnetic force, a procedure of converting a potential obtained under a gage-free or partially gage-free condition into a potential meeting the gage condition is executed before the procedure of  
25       developing the potential into the higher-harmonic components.

12. An electro-magnetic field analysis program of an

electric rotating machine according to claim 10 or 11, wherein  
a procedure of displaying the electro-magnetic field  
distribution, obtained through individual analysis in the  
above-mentioned each rotor space and stator space,  
5 individually by each assigned boundary condition.